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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,216	06/27/2003	Atsuko Kawasaki	09108.0002	5695

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FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

EXAMINER	
DIAZ, JOSE R	

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 12/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/607,216	KAWASAKI ET AL.
	Examiner	Art Unit
	José R. Díaz	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 7, 2005 has been entered.

Claim Objections

2. Claim 5 is objected to because of the following informalities: please correct the status of the claim from "New" to --Previously Presented--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 2004/0106292 A1) in view of Applicant's admitted prior art.

Regarding claim 1, Sato et al. teaches a method of producing semiconductor devices, comprising the steps of:

forming an etching resistive mask (consider the oxide film 2 and the nitride film 3) over a semiconductor substrate (1) (see fig. 2);

etching said semiconductor substrate through an opening (5) in said etching resistive mask to form a device isolation trench (6a) (see figs. 5-7);

forming a silicon oxide film from a coat of a silazane perhydride polymer solution ("polysilazane" 6c)[1] over said semiconductor substrate having said device isolation trench formed therein (see figs 10-11 and paragraph [0055], line 16);

removing said film of the silicon oxide (6c), except for a residue of silicon oxide (6c) remaining inside said device isolation trench (see figs. 12-13; and paragraph [0056], lines 5-8); and

[1] Please note that "silazane perhydride polymer" and "polysilazane" have the same chemical composition. For instance, Koyanagi (US Pat. No. 6,191,002 B1) in column 8, line 1 discloses the composition of the "silazane perhydride polymer" is $[(SiH_2NH)_n]$, and also, Nishiyama et al. (US 2003/0022522 A1) discloses the same composition in paragraph [0052] for "polysilazane."

after removing said film, heating (thermal processing) said residue for densification (see lines 8-12 of paragraph [0056]).

However, Sato et al. fails to teach how said silicon oxide film is formed from a coat of a silazane perhydride polymer solution. Specifically, Sato et al. fails to teach the steps of vaporizing a solvent from said coat and then subjecting said coat to chemical reaction to form the silicon oxide film. In addition, Sato et al. fails to teach the limitation of removing impurities for densification.

Applicant teaches that it is well known in the art to form the silicon oxide film from a coat of a silazane perhydride polymer solution by vaporizing a solvent from said coat [page 1, lines 35-36] and then, subjecting said coat to chemical reaction [see page 1, lines 33-35] to form the silicon oxide film [see page 2, lines 2-3]. In addition, Applicant teaches that impurities are removed during the heating step for densification of the silicon oxide film [page 2, lines 4-6].

Applicant's admitted prior art and Sato et al. are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a silicon oxide film from a coat of a silazane perhydride polymer solution by vaporizing a solvent from said coat and subjecting said coat to a chemical reaction; and to heat the silicon oxide to further remove impurities for densification. The motivation for doing so, as is taught by Applicant's admitted prior art, is to reduce crack formation in the silicon oxide film (page 2, lines 10-12). Therefore, it would have been obvious to combine Sato et al. with Applicant's admitted prior art to obtain the invention of claim 1.

4. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 2004/0106292 A1) in view of Applicant's admitted prior art, and further in view of Ahn (US Pat. No. 6,596,607 B2).

Regarding claims 2-3, a further difference between the prior art and the claimed invention is the step of forming a silicon oxide film over the surface of the etching resistive mask containing silicon nitride after the formation of the device isolation trench, before forming the coat of silazane perhydride polymer solution, and after etching said silicon nitride to etch back opening edges.

Ahn teaches a silicon oxide film (109) over the surface of the etching resistive mask containing silicon nitride (103) (see fig. 6), after the formation of the device isolation trench (121) (see figs. 5-6), before forming the coat of silazane perhydride polymer solution (119) (see fig. 6 and col. 4, lines 20-27 and 32-35), and after etching said silicon nitride (103) to etch back opening edges (see fig. 5 and col. 4, lines 8-10 and 13-15).

Applicant's admitted prior art, Sato et al. and Ahn are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a silicon oxide film over the surface of the etching resistive mask containing silicon nitride, after the formation of the device isolation trench, before forming the coat of silazane perhydride polymer solution, and after etching said silicon nitride to etch back opening edges. The motivation for doing so, as is taught by Ahn, is to provide an oxide barrier layer, which protects the silicon nitride layer during the oxidation process of the silazane

perhydride polymer solution (col. 4, lines 23-26). Therefore, it would have been obvious to combine Sato et al. with Applicant's admitted prior art to obtain the invention of claims 2-4.

Regarding claim 4, Ahn further teaches that the silicon oxide layer is formed by low pressure CVD (see col. 4, lines 20-23).

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 2004/0106292 A1) in view of Applicant's admitted prior art, and further in view of Koyanagi (US Pat. No. 6,191,002 B1).

Regarding claim 5, a further difference between the prior art and the present application is removing the film of silicon oxide by CMP. Koyanagi teaches that it is well known in the art to remove silicon oxide by CMP (see col. 8, lines 61-63).

Applicant's admitted prior art, Sato et al. and Koyanagi are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to remove silicon oxide by CMP. The motivation for doing so, as is taught by Koyanagi, is to flat the top surface of the oxide film (col. 8, lines 65-67). Therefore, it would have been obvious to combine Koyanagi with Sato et al. and Applicant's admitted prior art to obtain the invention of claims 5.

Response to Arguments

6. Applicant's arguments filed October 7, 2005 have been fully considered but they are not persuasive. Applicant argues that Sato et al. fails to teach the limitation of heating the residue to remove impurities for densification, after removing said film of the silicon oxide (page 6-8 or remarks). However, the examiner disagrees. Sato et al. explicitly teaches the claimed sequence of steps in figures 10-13 and paragraph [0056]. For instance, figures 10-11 show a silicon oxide layer (6c) formed from a coat of a silazane perhydride polymer solution; figures 12-13 show the step of removing the film of the silicon oxide to form a residue of silicon oxide (6c) in the isolation trench (6a); and paragraph [0056] further discloses the step of heating [lines 8-10 of paragraph 0056] the portion of the silicon oxide layer (6c) left in the isolation trench (6a) [lines 5-6 of paragraph 0056]. In other words, heating the residue of silicon oxide. Thus, Sato et al. teaches the claimed sequence of heating said residue, after removing said film of the silicon oxide.

As such the rejection is considered to be proper.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (571) 272-1727. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

José R. Díaz
Examiner
Art Unit 2815